Threatened Species Assessment

Colubotelson joyneri freshwater isopod

Taxonomy

Colubotelson joyneri (Nicholls, 1926)

The synonymised name is *Phreatoicus joyneri* Nicholls, 1926 (basionym). The family level taxonomy adopted follows that of Boyko et al. (2008).

The genetic work undertaken by Hatley and Murphy (2016) indicates there are two evolutionary significant units, or two species, of *Colubotelson* with overlapping distributions across the entire Bogong High Plains sample area.

Current conservation status

Categorised as Vulnerable in the 2009 Advisory list of threatened invertebrate fauna in Victoria (DSE 2009).

Proposed conservation status

Critically Endangered in Victoria

Criteria B1ab(iii)+2ab(iii)

Species Information

Description and Life History

Isopods, which are sometimes referred to as aquatic sowbugs, have over 950 species, rivalling the amphipods in terms of diversity, ecological importance and distribution (Wellborn et al. 2015). Isopods have among their number detritivores, carnivores, fish parasites, and scavengers. Isopods are primary consumers in many freshwater environments forming a key basal element in food webs, cycling nutrients and energy to higher trophic levels (Hatley and Murphy 2016). This species belongs to the Suborder Phreatoicidea, Family Phreatoicidae all of which are freshwater species. Phreatoicidean species tend to be short, or small range endemics, a pattern that is also seen in most genera, and in a few cases at the family-level (Wilson and Johnson 1999, Wilson, 2008). The Australian phreatoicideans have significant endemism at the generic and higher levels, and it is considered highly likely that there could be at least an order of magnitude more species than currently identified.

Specific ecological and biological information is lacking for this taxon, with the following text relating to peracarid isopods in general. As with all the peracarid crustaceans, isopod embryos undergo direct development within the female brood pouch (marsupium), from which they emerge as juveniles, known as manca. These are essentially small replicas of adults but lack the last pair of thoracic legs. There is no pelagic larval stage among the isopods. There is a large amount of data which indicates that peracarids are very poor overland dispersers, and is potentially limited to the crawling ability of the species, resulting in most species having highly restricted distributions and patterns of high endemism (Brusca, 1997, Wellborn et al. 2015).

Phreatoicidae typically reproduce multiple times over a lifetime (iteroparous life cycle). A related species, *Crenoicus buntiae*, occurs in sphagnum bogs in the highlands of NSW and Victoria, but is not a strictly alpine species as it is recorded at lower altitudes as well (Wilson and Ho 1996). *C. buntiae* reproduce year around with peaks during the warmer months, which suggests temperature driven metabolism (Wilson and Ho 1986, Buz Wilson, pers. comm. 2019). Wilson and Ho (1996) attributed subpopulations to each bog sampled as there were no individuals found in the connected streams or in the surrounding dry land.

C. buntiae young are released from the brood pouch at body lengths between 1.8-2.2 mm and start differentiating into males and females at lengths between 4-6 mm. Maturity may be attained around 6-7 mm, and adults may reach lengths greater than 14 mm in the males, or 12 mm in females. This species is probably iteroparous. Brooding females were observed at all sites throughout the study with mate guarding whenever samples were collected. Body length data suggests that *C.buntiae* breed asynchronously throughout the year. Whilst *C. buntiae* is assumed to have a similar life history strategy to that of *Colubetelson joyneri*, further work would be required to confirm this assumption.

Generation Length

The generation length of *C. joyneri* is inferred to be one year, inferred from the lifestyle of a similar species (Wilson and Ho 1996).

Distribution

The taxon was collected in 1925 and again in 1934, from several localities on and near the summit of Mt Buffalo. Although a prolonged search was made if was not found at or near the base of the mountain (Nicholls, 1944). A second record from Mt Stanley approximately 20 km north of Mt Buffalo was collected in 1988.

Clements (2009) observed six individuals in a macroinvertebrate survey conducted in the upper region of Whiterock Creek valley in the Bogong High Plains in 2008-2009. Clements et al. (2016) in a subsequent publication, the species was described as *Colubitelson* 'nr' *joyneri*, but considered it to be the same species as that present on Mt Buffalo (P. Suter pers. comm. 2019).

Hatley and Murphy (2016) collected 153 individuals from 14 sites on the Bogong High Plains from the headwaters of six creek systems: White Rocks Creek, Buckety Plains Creek, Middle Creek, Cope Creek, Rocky Valley Creek (upstream of the reservoir) and McKay Creek. The genetic work undertaken by Hatley and Murphy (2016) indicates there are two evolutionary significant units, or two species, of *Colubotelson* with overlapping distributions across the entire Bogong High Plains sample area. Their results also indicated that there was some highly limited population connectivity among sites in adjacent headwaters. Most of the sampling sites were less than 100m apart, but the creek systems were remotely hydrologically connected over 300km at the Murray River.

Timms (1974) describes the distribution of *C. joyneri* as a function of depth within Lake Tarli Karng in East Gippsland, however this record is in doubt. Crowther et al. (2008) stated that Hawking (1998) collected a specimen of *C. joyneri* in 1997 from Running Jump Creek near Cresta Inn (Mt Buffalo).

Habitat

Specimens were collected from black ooze in shallow ditches and puddles, beneath sphagnum in boggy areas and in fairly fast-flowing creeks. Specimens were also taken sparingly along the banks of Lake Catani (Mt Buffalo); but not in the reservoir. Nicholls (1944) noted that this species seems to require sheltered areas.

Clements (2009) observed six individuals in bryophyte pools, which have distinctive species in the genera *Blindia*, *Bartramia* and *Brutelia*, but lack *Sphagnum*. The bryophyte pools are groundwater fed and have distinctive structural layers. The upper consists of uncompressed, live, photosynthetic vegetation with free water gently flowing; a middle layer of densely packed roots and detritus; and the bottom of densely packed sediment and detritus. In some locations the was free flowing water between the mid and bottom layer (Clements 2009). These pools are very small, being less than 6m^2 in surface area and on average 24-54 cm deep. Pool temperatures were constrained to 5.6-6.3° C despite air temperatures varying between -4.5°C and 30.6°C (Clements et al. 2016). Clements et al. (2016) refer to these pools as source pools as they occur upstream of sphagnum bogs which are much larger. They are a very restricted habitat representing less than 0.1 ha on the Bogong High Plains but are important as a water source to endangered peatlands (Clements et al. 2016).

Wislon and Ho (1996) found similar results for the related species *Crenoicus buntiae*, that there had to be free flowing water. They observed that Crenoicus was predominantly found in the subsurface, pigmentless or brown decaying parts of the fronds, and not in the surface greener actively growing vegetation.

Threats

Crowther et al. (2008) stated that climate change, bushfires and resort development are threats to the taxon. The findings of Hatley and Murphy (2016) indicate that habitat loss and/or fragmentation associated with environmental

change will result in biodiversity reductions, with taxa unlikely to shift their ranges in response to future climate change, or recover rapidly from localised extinction events.

The taxon occurs in isolated subpopulations, potentially genetically distinct (or having multiple species present), that are highly susceptible to habitat fragmentation and impacts from climate change. The bushfires of 2019/2020 may have impacted the water quality within the taxon's distribution.

IUCN Criteria

Criterion A. Population size reduction.
Population reduction (measured over the longer of 10 years or 3 generations) based on any of A1 to A4

	Critically Endangered	Endangered	Vulnerable
A1	≥ 90%	≥ 70%	≥ 50%
A2, A3, A4	≥ 80%	≥ 50%	≥ 30%

A1 Population reduction observed, estimated, inferred or suspected in the past and the causes of the reduction are clearly reversible AND understood AND ceased.

A2 Population reduction observed, estimated, inferred or suspected in the past where the causes of the reduction may not have ceased OR may not be understood OR may not be reversible.

A3 Population reduction, projected or suspected to be met in the future (up to a maximum of 100 years) [(*a) cannot be used for A3*]

A4 An observed, estimated, inferred, projected or suspected population reduction where the time period must include both the past and the future (up to a max. of 100 years in future), and where the causes of reduction may not have ceased OR may not be understood OR may not be reversible.

based on any of the following:

(a) direct observation [*except A3*]

(b) an index of abundance appropriate to the taxon

(c) a decline in area of occupancy, extent of occurrence and/or quality of habitat

(d) actual or potential levels of exploitation

(e) the effects of introduced taxa, hybridization, pathogens, pollutants, competitors or parasites

Evidence:

Ineligible under Criterion A

There is insufficient evidence to determine whether there has been or will be a reduction in population sufficient to meet any threshold for Criterion A.

Criterion B. Geographic range in the form of either B1 (extent of occurrence) and/or B2 (area of occupancy	Critically Endangered Very restricted	Endangered Restricted	Vulnerable Limited
B1. Extent of occurrence (EOO)	< 100 km²	< 5,000 km²	< 20,000 km²
B2. Area of occupancy (AOO)	< 10 km²	< 500 km²	< 2,000 km²
AND at least 2 of the following 3 conditions:			
(a) Severely fragmented OR Number of locations	= 1	≤ 5	≤ 10
(b) Continuing decline observed, estimated, inferred or projected in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) area, extent and/or quality of habitat; (iv) number of locations or subpopulations; (v) number of mature individuals			
(c) Extreme fluctuations in any of: (i) extent of occurrence; (ii) area of occupancy; (iii) number of locations or subpopulations; (iv) number of mature individuals			

Evidence:

Eligible under Criterion B1 as Critically Endangered

The Extent of Occurrence (EoO) across the taxon's range is estimated to be 8 km², based on accepted, post-1970 records from the Victorian Biodiversity Atlas (VBA).

The taxon is estimated to be severely fragmented. Habitat specialisation by alpine freshwater organisms, including *C. joyneri* precludes gene flow through the drainage network, but for some species limited dispersal can occur over short distance between potentially connected headwaters (Hatley and Murphy 2016). Alpine isopods are therefore susceptible to habitat fragmentation.

It is inferred to have three locations, Mt Buffalo, near Mt Stanley (north of Mt Buffalo) and Bogong High Plains.

It is inferred to have a continuing decline in (iii) above, as it is an alpine taxon, and such taxa are prone to range contraction due to climate change.

Eligible under Criterion B2 as Critically Endangered

The Area of Occupancy (AoO) across the taxon's range is estimated to be 8 km², based on 2 x 2 km grids derived from accepted, post-1970 records in the VBA (As above it is severely fragmented, has three locations and has a continuing decline in (iii) above.

Criterion C. Small Population size and decline				
		Critically Endangered	Endangered	Vulnerable
Number of mature individuals		< 250	< 2,500	< 10,000
AND at least one of C1 or C2				
C1	An observed, estimated or projected continuing decline of at least (up to a max. of 100 years in future):	25% in 3 years or 1 generation (whichever is longer)	20% in 5 years or 2 generations (whichever is longer)	10% in 10 years or 3 generations (whichever is longer)
C2	An observed, estimated, projected or inferred continuing decline AND least 1 of the following 3 conditions:			
(a)	(i) Number of mature individuals in each subpopulation	≤ 50	≤ 250	≤ 1,000
	(ii) % of mature individuals in one subpopulation =	90 – 100%	95 – 100%	100%
(b) Extreme fluctuations in the number of mature individuals				

Evidence:

Ineligible under Criterion C as Data Deficient

There is insufficient evidence to determine the number of mature individuals.

Criterion D. Very small or restricted population			
	Critically Endangered	Endangered	Vulnerable
Number of mature individuals (observed or estimated)	<·50	<·250	<·1,000
D2 Only applies to the VU category Restricted area of occupancy or number of locations with a plausible future threat that could drive the species to critically endangered or Extinct in a very short time.	-	-	D2. Typically: AoO <·20 km2 or number of locations ≤ 5

Evidence:

Eligible under criterion D2 as Vulnerable

The taxon is estimated to be very restricted.

Criterion E (Quantitative Analysis) was not addressed as the taxon does not have a detailed Population Viability Analysis.

References

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